# WORKING PLAN

## Coastal Grizzly Research Project

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A Cooperative Project Between the Ministries of
Environment and Forests

Wildlife Branch
Ministry of Environment
Victoria, B.C.

Research Branch
Ministry of Forests
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# INTRODUCTION

In the early 1970's, the Fish and Wildlife Branch targeted coastal grizzly bears for further research. To identify and rank specific research needs, the Research Section of the Fish and Wildlife Branch conducted a problem analysis (Archibald 1983). This analysis led to the following list of research topics ranked in relation to the needs of management:

1. What are the seasonal habitat requirements of coastal grizzly bears?

2. What effects do forest practices have on grizzly bear habitat and its management?

3. What are the population characteristics of coastal grizzly bears?

The objective of this working plan is to describe each of the above research topics in terms of research objectives, hypotheses, confounding factors, and methodologies.

Three non-research topics were also identified in the problem analysis as priority items. These were:

1. Development of a garbage policy for remote camps that would eliminate garbage as an attractant to coastal bears.

2. Development of a formal policy on habitat protection guidelines for grizzly bears.

3. Development of an information/education program to be delivered to all personnel working in coastal watersheds.

Suggestions for dealing with these topics are presented. A glossary of terms used in the project is also provided.

The coastal grizzly research project is a cooperative one between the Ministries of Environment and Forests. The proposed duration of the project is five years - four in the study area and one synoptic.

## STUDY AREA

To meet project objectives, four criteria were used to select the study area:

1. a high resident population of grizzly bears;
2. high salmon values;
3. ecology that was representative of coastal British Columbia; and
4. active logging during the course of the study.

Five watersheds were examined; the area selected was the Kimsquit River valley. The study area is located at the head of Dean Channel, about 500 km northwest of Vancouver, and includes the entire Kimsquit River basin (Fig. 1).

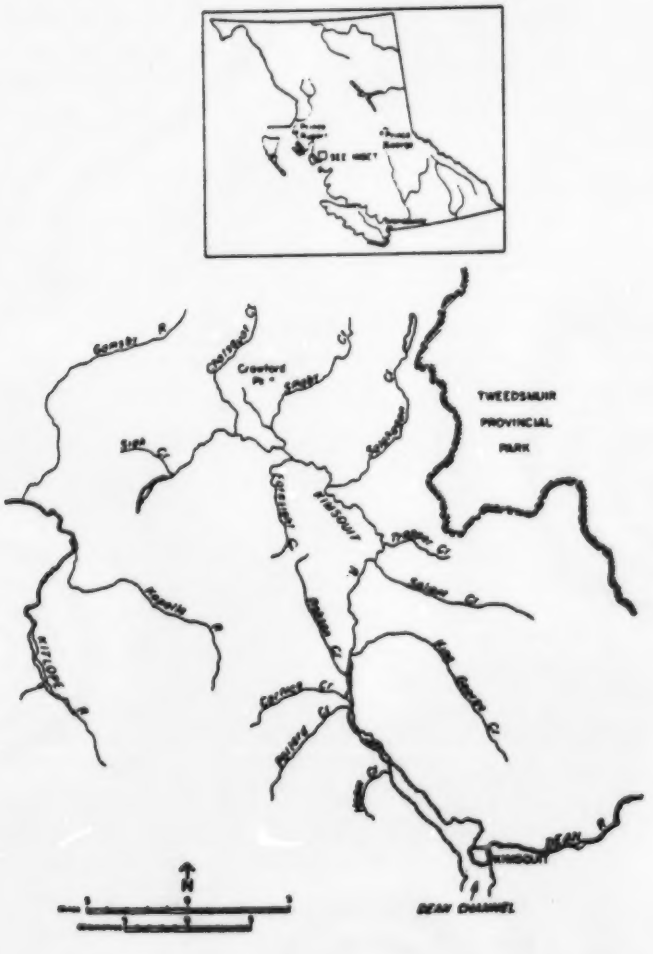


Figure 1. LOCATION OF STUDY AREA

# FIELD METHODS

## CAPTURING TECHNIQUES

A variety of capturing techniques will be used. Emphasis will be placed on using the most appropriate technique for the conditions.

In the spring, capturing will likely be done by immobilizing free-ranging grizzly bears immediately following their emergence from winter dens (D. McKnight, pers. comm., 1981), and by snaring (J. Nagy, pers. comm., 1981).

For snaring, a trapline of 35- to 40 snare sites will be established and checked by helicopter. The line will be serviced daily during the trapping season by at least two trained people.. Radio transmitters will be attached to each snare so that activity at each site can be monitored from the air.

Traps will be placed in areas known to be frequented by coastal grizzly bears early in the spring (Russell 1974; A. Edie, pers. comm., 1981). Trapping will continue until bears are no longer coming to bait or until the ratio of new grizzly captures to the total number of grizzly captures approaches zero.

Later in the season, a ground-monitored trapline will be established. This trapline will be checked at least daily by boat or truck as access conditions permit. Trap sites will be established in known or suspected areas of grizzly activity, such as along the river during salmon runs. Both baited and trail sets will be used.

## HANDLING TECHNIQUES

Grizzly bears will be immobilized with M99 at dosages established previously (Hebert et al. 1980). M99 has been chosen for several reasons:

1. lower volumes are required than other drugs, thus lessening tissue damage and allowing for better delivery trajectory;

2. M99 has an antidote ,thus minimizing immobilization time;

3. M99 produces consistent patterns of immobilization and thus is safer. Black bears will be immobilized with a Ketamine-Rompun mixture to reduce costs when feasible (Hebert et al. 1980).

Adult grizzly bears will be fitted with fixed diameter radio collars that are motion-sensitive. Yearling and sub-adult grizzly bears will be fitted with either implanted transmitters (Philo et al. 1981) or ear tag transmitters (Servheen et al. 1981). Battery life for the radio collars is estimated at 36 months. Implants can be expected to last 24 months and have no appreciable difference in range (S. Tomkiewicz, pers. comm., 1981).

All bears will be fitted with plastic ear tags, individually numbered. In addition to the tags, colour-coded flags sewn from doubled, brightly coloured Herculite cloth will be attached on the back of the ears to make identification from a distance easier. Uncollared black bears may receive additional visual marking for long distance identification (e.g. visual collars made from seat belt material and fluorescent Herculite).

Captured bears will be weighed to the nearest kilogram by suspending the bear in a cargo net from a scale mounted beneath the helicopter, or by suspending them from a portable aluminum tripod using a come-along. Respiration rate of captured bears will be measured to monitor immobilization. To determine age, a first premolar tooth will be removed from each captured bear older than first year cubs. General examinations of body condition (e.g. evidence of fighting, ectoparasites, swelling of vulva) will be made, body measurements done, and photos taken. A copy of the capture data sheet is in Appendix A.

## RESEARCH TOPICS

### SEASONAL HABITAT USE

#### Objectives

The management objective is to protect critical habitat of grizzly bears in coastal British Columbia from adverse modification or destruction by human activities. "Critical" habitat is broadly defined as those portions of occupied habitat essential to the maintenance and continued survival of coastal grizzly bears during any part of their life cycle (Schneegas and Frounfelker 1980).

The research objectives aim for a better understanding of how coastal grizzly bears use their habitat. More specifically, the objectives are:

1. to identify discrete habitat units of grizzly bear in coastal B.C.;
2. to investigate the requirements (social interaction, nutrition, denning) being met by these habitat units;
3. to observe and attempt to categorize "seasonal" movement patterns between these habitat units, by the different sex and age classes of coastal grizzly bears;
4. to determine the home ranges and degrees of overlap among the different sex and age classes ("seasonal" home range, annual home range, five-year home range);
5. to combine information from the above objectives in order to evaluate the relative contribution of the specific habitat units to the continued maintenance and survival of coastal grizzly populations.

#### Feeding Ecology

**1. Hypotheses**

**Hypothesis: Seasonal availability and phenology of highly digestible, energy-rich plants and plant parts of limited distribution affect habitat use by grizzly bears in the Kimsquit.**

Information from food habits and feeding site investigations, the monitoring of daily and seasonal movements of collared animals, food plant phenology and productivity plots, and nutrient content analyses (energy, fibre, and protein) will help to identify specific habitat units. Though the hypothesis is worded generally and will be difficult to test adequately, it will be rejected if no correlation is found between these unique habitat units and the movements of collared animals. Areas such as subalpine sedge meadows, avalanche chutes, the estuary (cow parsnip and sedges), and moist poorly drained areas in mature forest (skunk cabbage) are expected to form the majority of these habitat units. If productive berry-producing areas can be delineated and are regularly used, they will also be included.

> Hypothesis: The abundance and accessibility to grizzly bears of spawning salmon affect habitat use by grizzly bears in the Kimsquit.

The onset, duration, and magnitude of spawning salmon runs will be monitored. If no positive correlation between the availability of spawning salmon accessible to grizzly bears in the Kimsquit and bear movements to the spawning areas is found, then the hypothesis will be rejected.

> Hypothesis: The opportunity of finding animal food items other than salmon affects habitat use by grizzly bears in the Kimsquit.

Food habits and feeding site investigations will yield information on other animal species eaten by grizzly bears. If no verifiable evidence of predation or scavenging by collared grizzly bears in the Kimsquit is found, then the hypothesis will be rejected.

### 2. Confounding Factors

Some seasonally important food plant species, such as devil's club, salmonberry, and *Vaccinium* spp., will probably be abundant and widely distributed. Correlations between the occurrence of phenological stage and bear use of these widespread species would be of limited value given the total area, annual variation in berry productivity, and the variety of habitats involved. Therefore, investigations will be concentrated on those plant species of limited distribution. However, the widely distributed species could in fact have "critical" importance if their use by grizzly bears is restricted by some associated habitat requirement(s). For example, a particular berry-producing area may not be used if available cover is lacking. During feeding site investigations, patterns will be sought to shed light on when and how the widely distributed plant species are used.

Another confounding factor in the Kimsquit study is that habitat use investigations contain "noise". Examples are:

- Seasonal distribution of some age and sex classes may be governed by intraspecific interactions such as females with cub(s)-of-the -year and breeding animals, and by interspecific interaction such as with black bears.

- During the active season, movements and activity within and between habitats may be determined in part by climate - snowpack, daybed use in

heavy rains (Lloyd 1979), or terrain.

- Grizzly bears are "opportunistic omnivores" that do not necessarily restrict themselves to one or two food plant species at a time. Habitat values for these units which contain more than one main food source will be difficult to assign.

- Restricted ground access will limit detailed habitat use analysis to a small sample of the different sex and age classes. As a result, use patterns unique to the Kimsquit may be over-emphasized, and habitats important elsewhere may be overlooked.

- The Kimsquit appears to have a high density of black bears that may confound some data collection, e.g. separating grizzly scats from those of black bear.

### 3. Proposed Methodology

Six "seasons" of coastal grizzly bear habitat use have been identified and defined based on existing information:

i. emergence to valley floor leaf-flush

ii. valley floor leaf-flush to avalanche chute green-up

iii. avalanche chute green-up to berry production and salmon availability

iv. berry production and salmon availability to the end of both

v. time remaining until denning

vi. den entrance until emergence

These "seasonal" definitions will be field-tested and modified if necessary. Animal variations in the seasonal patterns will be carefully examined.

Home range determination:

To determine home ranges, Voigt and Lotimer (1980) suggest that 40 fixes will generate an accurate seasonal home range if the researcher is familiar with the activity patterns of the study species. Assuming a "den-to-den" period averaging seven months (April to November), radio fixes will have to be made every five to six days to obtain a sample of 40. In the first year, home range monitoring will proceed on this schedule within the constraints of weather, study area logistics, and budget. As the sample size increases, regular assessments will be made to establish a priority system for relocation frequency.

Sampling for home range data will be done primarily from fixed-wing aircraft. We expect that the level of precision will be within 200 $m^2$ using this technique. Standard 1:50 000 topographic scale maps will be used for recording the location of fixes during monitoring flights, so that uncertain areas can be sketched directly onto the correct topographical feature. Ground monitoring for home range data may also be possible, depending on study area access. Sample monitoring forms are presented in Appendix B.

Annual home ranges will be delineated using Harestad's (1981) analysis of 100%, 90%, and 50% home ranges and the minimum area method (Mohr 1947). Seasonal home range delineation will also be attempted as sample sizes permit (Garshelis and Pelton 1981).

Vegetative mapping:

Vegetative mapping is expected to be an ongoing task for the duration of the project. Initially, four sources for vegetation classification of the Kimsquit will be used:

- existing forest cover maps (1:31 680), based on 1963 aerial photographs
- forest cover information (1:20 000) from 20-year harvesting projection maps produced by Doman Industries Limited, John G. Liveland and Associates Limited, and Integrated Resources Photography Limited. These maps, based on 1977 aerial photography, could be enlarged to 1:10 000 or 1:5000.
- Prince Rupert Forest Region, biogeoclimatic classification of the Coastal Western Hemlock zone - Kimsquit River preliminary mapping (1:20 000) for subunit plan, as available
- B.C. Ministries of Forests, Prince Rupert District, and Agriculture, Soils Branch, Kelowna - Landform, Topography Map of Kimsquit Watershed 1975 (1:50 000)

After preliminary field testing, the available maps will be evaluated for their effectiveness in delineating bear habitat units.

Additional large scale mapping, primarily based on the occurrence, percent cover, and productivity of food plant species may be attempted for selected areas within the Kimsquit watershed. Additional sources of information could be obtained from feeding site investigation within the home ranges of "resident" bears; permanent plot information, i.e. species composition, productivity; and, low level colour infra-red photography (Prince Rupert Forest District, Mid Coast Forest District, 70 mm boom). Concentrated effort will be made to correlate the presence of bear food species, productivity, and use with existing forest cover maps, as these are the only sources of information for much of the coast.

Establishment of permanent plots:

Permanent berry plots and riverside monitoring stations will be established at selected locations throughout the study area to monitor annual berry productivity and salmon runs. Information will be collected several times throughout the season of availability. Samples of known food plants will be collected at standard intervals for analyses of protein, crude fibre, and energy. Comparison of these data with relocation information may explain abnormalities in "seasonal" habitat shifting such as might occur with a berry crop failure. Berry productivity between habitats may also be compared. Total counts within exclosures of standard size will be made at two-week intervals beginning at berry formation (green counts) and continuing until frost kill (Ruff 1978).

Aerial relocation habitat data collection:

Preliminary interpretation of habitat selection by season, sex, and age will be possible by correlating telemetry location data with existing vegetation maps. Radio-fixes will be transferred to these maps after each flight and the appropriate type(s) recorded. Mylar overlays (1:20 000) may be used. Potential factors, such as difficulty in pinpointing locations and influence on bear movement by the aircraft, may limit the value of the habitat use data. It will, however, provide a basis for further investigations.

Ground relocation habitat data collection:

Where possible, bears first located from the air will be relocated soon after from the ground. If feasible, the collared bears will be observed from a distance to record activity patterns, feeding strategies, and movements (Rogers 1977; Blanshard 1980; Hamer et al. 1980; Hechtel 1980; Stelmock 1981). Direct observations will be followed by feeding site investigation. This method will allow collection of dated scats from known animals and verification of food type selection by season, sex, and age. Data on easily digested food items such as mushrooms or animal carcasses which are rarely revealed through scat analysis will also be sought during site investigations. Site specific information will be collected with emphasis given to vegetative typing and measuring the occurrence, distribution, phenology, and pattern of use of the food type(s) in the vicinity (Lloyd 1979; Zager 1980). An example of the form for recording feeding site information is presented in Appendix C.

Where direct observation of known bears is not possible, telemetry relocations will be followed up by ground searches for feeding sites. Most often, these searches will be restricted to areas known to have recent bear use and with easy ground access (Sizemore 1980). Once located, site information collected will be as outlined for direct observation location. Periodic visits to more remote areas of known bear use will be attempted.

While careful effort will be made to monitor habitat selection of representatives of each sex and age class, it is likely that detailed information on daily movements and activity patterns will only be recorded for a small sample of the resident population. Logistics of working in a coastal environment preclude obtaining detailed ground information from every collared animal. Costs will restrict helicopter use to a few selected times throughout the active season. Recognizing this, a priority system will be developed that identifies which sex and age classes are the most important to document. Grizzly bear family units will receive special emphasis because: they may be more sensitive to habitat alteration than other sex and age classes (Smith 1978); they have relatively small home ranges enabling more frequent ground telemetry relocation and subsequent feeding site checks; the welfare of the producing-age females is critical to the continued survival of coastal grizzly bear; and, two family groups (each with two yearling cubs) have been captured and appear to be resident in the lower valley.

To satisfy the research objective regarding why bears make use of a particular habitat unit, information on mark trees, daybeds, and travel routes (i.e. requirements other than nutrition) will be sought while monitoring bear locations. Information regarding intraspecific interactions may also be obtained when two or more collared individuals are in the same area.

Data analysis:

Once identified, a combination of vegetative mapping, annual productivity measurements, and specific relocation information will be integrated to develop a use/value index for bear habitat units (Mealy et al. 1976; Lloyd 1979). These indices will be primarily based on occurrence, percent cover, quality, and timing of availability to bears of food items present. Additional evaluation of cover value - thermal and security - will also be attempted and included when assigning overall values (e.g. daybed habitat). Effort will be made to allow the evaluation system to be applied elsewhere on the coast using a combination of remote sensing, existing vegetation maps, and a minimum of site information.

**Breeding habitat**

**1. Hypothesis**

Hypothesis: While together, estrus female grizzly bears in the Kimsquit and their mates confine their activities to a very narrow range of habitat units.

Capture and monitoring of collared animals will provide data on the onset and duration of estrus and the movements and habitat selectivity of breeding pairs. If, during the life of the study, breeding animals are found to use a broad range of habitat types at various elevations, then the hypothesis will be rejected.

**2. Confounding Factors**

Because of the terrain in the Kimsquit, it will be difficult to determine if a collared grizzly bear has a mate, particularly if the mate has no collar and to monitor breeding pairs effectively and without disturbance.

Another problem may be insufficient opportunities to monitor breeding activity. Because of grizzly bears' low reproductive rate and the anticipated small sample size of marked individuals, breeding activity will likely be monitored less than 20 times during the life of the study.

**3. Proposed Methodology**

Monitoring as outlined in the previous section will also provide information on activity and location of adult males and producing-age, single females. Careful record of the movements of these animals will be kept during June and until mid-July. Where possible, helicopter relocations will be used to verify if two grizzlies are together. If it can be determined conclusively that two adult grizzlies are paired, then monitoring their locations will provide information on how long they travel together, and if there is any evidence of critical breeding areas (Herrero and Hamer 1977). If such areas are found, then detailed assessment and mapping of various characteristics will be attempted for future protective measures. Examination of the vulva of captured females during the spring and early summer will help to determine the time and length of estrus.

### Denning habitat

#### 1. Hypothesis

Hypothesis: Specific requirements for denning habitat of grizzly bears in the Kimsquit (slope, substrate, aspect, elevation, snow accumulation) are met by only a limited number of suitable sites within the watershed.

Monitoring of collared animals and early spring reconnaissance flights will locate den sites in the study area. After bears have left the den area, information and measurements to characterize denning requirements will be collected. If dens are found over a wide range of slopes, substrates, aspects, elevations, and snow accumulations, then the hypothesis will be rejected.

#### 2. Confounding Factors

Two potential problems are foreseen. First, the nature of the terrain may prevent telemetry location of den sites, thus limiting the sample size. Second, the coastal winters may be mild enough that some sex and age classes of the collared animals will not den.

#### 3. Proposed Methodology

General den locations and the onset of denning will be determined during the fixed-wing monitoring flights of radio-collared bears. A helicopter will be used to determine den locations. These locations will be recorded on the 1:50 000 scale map and 1:20 000 air photos. Monthly monitoring flights during the winter will test fidelity to dens.

Beginning in mid-April, weekly fixed-wing flights will record when bears emerge. After sufficient snowmelt, the site will be visited by helicopter to measure and record site and den characteristics, such as vegetation, size, shape, and bedding material. If the sample size is sufficient, statistical tests will be applied to these data to identify criteria for den site selection. An accurate method of quantifying the availability of such areas will be attempted.

## EFFECTS OF FOREST PRACTICES

### Objectives

The prime management objective is to minimize any adverse impacts of timber harvest on coastal grizzly bear habitat, distribution, and population density during and subsequent to timber removal.

There are three research objectives related to the management objective:

1. to assess and quantify the impacts of timber harvest on natural patterns of seasonal habitat use by different sex and age classes of coastal grizzly bears during timber removal, in the immediate short-term (one to five years), in the intermediate (midterm) years (5- to 15 years), and in the long term (15 years to harvest of second growth).

2. to identify and monitor any major influences of forestry activity on the distribution and densities of coastal grizzly bears.

3. to continue with the development of habitat protection guidelines for coastal grizzly bears.

**Hypotheses**

Hypothesis: Present systems of timber harvest in coastal B.C. alter natural patterns of habitat use by coastal grizzly bears.

Although some logging has occurred in the Kimsquit valley floor, comparisons of habitat use patterns of collared grizzly bears pre- and post-logging will still be possible. If the seasonal pattern of timing and of areas of habitat use is significantly altered, the hypothesis will be supported. The occurrence and productivity of food species in logged areas formerly used will be measured. Post-logging movement information will also be collected. If logged areas are used by collared bears, distinction between the pre- and post-logging patterns will be sought.

Hypothesis: Present systems of timber harvest in coastal B.C. result in declines in grizzly bear population densities in logged areas during and subsequent to timber removal, in the absence of direct mortality by man.

If collared grizzly bears resident in an area scheduled for logging leave and do not return after timber removal is completed, the hypothesis will be supported. Although difficult to quantify, increases in cub production, cub mortality, the amounts of home range overlap, dispersal, and local density in adjacent areas will also tend to support the hypothesis.

Hypothesis: Present systems of timber harvest in coastal B.C. can be manipulated in space and time to minimize their impact on grizzly bear seasonal habitat use, distribution, and population density.

Various systems of timber harvest and site treatment may be introduced into the home ranges of collared bears. Attempts will be made to assess the relative impacts of these practices. If more use and higher bear densities occur in an area given one treatment than in an area given another treatment, the hypothesis will be supported.

**Confounding Factors**

It may be difficult to isolate the effects of forest practices on habitat use from the natural influences of climate, annual variability of food production, and social interaction (refer to Confounding Factors section of Seasonal Habitat Use).

During the life of the study, the maximum age of any of the cut areas will be six years. Most questions regarding the longer term effects of logging will have to be addressed outside the Kimsquit watershed (see Proposed Methodology in the Seasonal Habitat Use section). If collared grizzly bears are not found using cut areas, it will be difficult to explain why (e.g. lack of food or cover, difficulty of travel, noise, vehicles). Much of the information

obtained towards testing these hypotheses will be qualitative only. Logistics, sample size, and the realities of working on such a slow reproducing, low-density animal as the grizzly bear will limit the amount of data collected.

### Proposed Methodology

The section on Seasonal Habitat Use will provide baseline information on how coastal grizzly bears select and use habitat in an undisturbed watershed. Logging will be introduced during the course of the study and its effects on bear movement, activity, density, and food species production (Mace 1980; Zager 1980) will be monitored. These data should provide insights on the specific effects of timber harvest and site treatment techniques on grizzly bears and their foods. Ideally, all sex and age classes could be monitored seasonally. However, emphasis will be directed towards those animals for which detailed movement and diet information have already been obtained. Modifications to cutting plans and site treatments may be necessary. Ideally, collared animals would have access to a variety of cut block configurations and site treatments of varying ages. The details of cutting plans and site treatments will be examined early in the project in consultation with the MOF and the forest company. Special effort will be made to attribute specific effects to specific treatments.

Monitoring during logging and post-logging should identify the short-term effects of logging on the collared resident grizzly bears. Ideally, the study would continue for a full forest rotation to monitor the long-term effects. Since this is not possible, satellite study areas will be established in differently aged forest stands. Emphasis will be placed on establishing these areas in regions that are ecologically similar to the primary study area. Permanent plots will be established in these satellite areas to monitor grizzly food productivity. These data will be compared with the data gathered from the permanent plots on the primary study area.

There are two other possibilities of supplementing the data regarding the longer term effects of logging on coastal grizzly bears. Much of the first four miles of the valley floor of the Kimsquit was logged between 1918 and 1920. While historic files regarding this operation have yet to be located, specifics about dates, methodologies, and species composition removed will be sought. At present, collared animals make use of some of the second growth areas, primarily cottonwood stands. Another possibility is that some collared animals may make use of the logged areas in the Dean River watershed, 9 km down Dean Channel from the Kimsquit. Ground investigations of bear use, food species occurrence, and production could be made in this mosaic of forest stands. A historic file on the Dean River logging is available.

## POPULATION CHARACTERISTICS

### Objectives

Management objectives are to ensure the continued survival of viable grizzly bear populations in watersheds along the B.C. coast, and to provide opportunities for sport hunting of coastal grizzly bear.

Research objectives are to define discrete grizzly bear populations on the basis of ecological characteristics, and to determine population density, reproductive rate, and the sex and age composition of a coastal grizzly population in an unhunted watershed.

**Hypotheses**

Hypothesis: The capability of a coastal watershed to support a resident population of grizzly bears is a function of the availability and the size of salmon runs. Because the Kimsquit River has high salmon values and provides good access to spawning salmon, it supports a resident population of grizzly bears.

Intensive capture effort during the spring and early summer should capture most of the grizzly bears in the study area. Individual bear movements will be monitored from "den-to-den" to determine their home ranges. If resident bears are moving out of the watershed to fulfill any portion of their annual life cycle, then the hypothesis will be rejected.

Hypothesis: The Kimsquit attracts grizzly bears from neighbouring watersheds with lower salmon values during spawning.

Intensive capture effort along the Kimsquit during spawning should capture some transient bears. The hypothesis will be rejected if there is not an influx of transient bears during spawning or no fall-captured grizzly bears leave the valley after the completion of spawning and return the following year.

**Confounding Factors**

Grizzly bears from neighbouring watersheds may use the study area seasonally and resident bears may make periodic forays out of the study area causing difficulty in defining the resident population. Watershed fidelity of subadult resident grizzly bears will likely be confounded by natural dispersal activity. Movements between watersheds may be a function of intraspecific competition or aggression, related to obtaining highly concentrated, easily digested food sources, or related to behavioural requirements such as finding isolation for breeding or rearing cubs.

**Proposed Methodology**

The exact location of radio-collared bears will be determined as outlined earlier. The locations of transient and dispersing bears will only be determined as time and money permit.

**Density:**

Intensive trapping effort throughout the first year and during the spring and fall seasons for subsequent years should give estimates of grizzly density in the Kimsquit.

Reproductive rate:

By monitoring a sample of female adults, information will be gathered on average litter size, interval between litters, and the age of first reproduction.

Sex/age structure:

The sample of bears captured during the life of the project will provide information on the sex/age structure of an unhunted coastal grizzly population.

## OTHER RESEARCH TOPICS

During the course of gathering information to address the research topics outlined above, additional data on grizzly bears will be collected on the following topics:

- condition: information such as seasonal weight changes, ectoparasite loads, size, and some blood parameters will be gathered during the course of handling bears to provide insight on the condition of free-ranging grizzly bears.

- age-specific mortality: because the radio collars are mortality-sensitive, data can be collected on age, location, date, and the probable proximate cause of death. Mortality rates will be calculated from these data if the sample size is adequate. These rates will be incorporated into existing population models to estimate harvest rates and population trends, assuming the data from tagged bears are representative of the remaining and other populations.

# OTHER TOPICS

The topics discussed in this section are not specifically the responsibility of the Research Section. However, Research can play a role by synthesizing and evaluating existing information and making it available to the appropriate section or branch within the Ministry of Environment. Research needs to work closely with these groups to ensure an effective, integrated approach to the management of coastal grizzly bears. The value of our research depends upon a coordinated strategy.

## REMOTE CAMP GARBAGE POLICY

Representatives from the Ministries of Environment and Forests formed a provincial committee to study the waste management/bear problem. This committee has been largely ineffectual and may be disbanded. The need for provincial policy has lessened as regions develop their own policy, e.g. Regions 5 and 7 now require all remote camps to have incinerators. Since the reorganization and regionalization of the Ministry of Environment, the waste management/bear problem seems to be improving. The role of research in this problem will be explored during the course of this project.

## HABITAT PROTECTION GUIDELINES

Forestry operations in coastal watersheds are dramatically altering grizzly habitat. Ministry of Environment regions have habitat protection guidelines, but the lack of coordinated guidelines endorsed by the Ministry of Environment limits their effectiveness.

The guidelines should be cooperatively developed by personnel from the Fisheries Branch, the Wildlife Branch, and the Ministry of Forests by reviewing the existing research data on coastal grizzly bears, by examining current regional guidelines, and by evaluating the effectiveness of current habitat protection techniques. Development of these guidelines may identify additional research questions.

## INFORMATION/EDUCATION

The long-term welfare of the coastal grizzly bear depends on the people with whom they interact. A program must be developed to create positive attitudes in coastal workers towards grizzly bears. Research will work closely with Information Services and regional staff in developing this program.

Program content should include: annual life history of coastal grizzly bears, feeding patterns, and sources of conflict. As well, the program should have certain conceptual components including: the global significance of coastal grizzly populations, the ecological value of grizzly bears, and the responsibility of man for the bears' welfare.

The success of this type of program will depend on program design and delivery method. An entertaining, interactive format is needed. It should be designed such that the presentation can be made at different levels, depending on the audience. We propose that the firm E.S.S.A. be contracted to design and develop the program as they have recognized expertise in communications regarding issues in natural resource management. Program delivery should be restricted to Fisheries and Wildlife personnel. When the package has been developed, staff in regions with coastal areas will be schooled in the delivery of the program. The program should reach as many coastal mainland workers as possible. The mechanism for accomplishing this will be left to regional personnel.

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## GLOSSARY

Cover - a habitat requirement for protection that can be subdivided into categories:

i. escape cover or security cover - required for the avoidance of predators or aggressive conspecifics.
ii. resting or sleeping cover - e.g. daybeds.
iii. thermal cover - required for the maintenance of body temperature - e.g. avoidance of wind, extreme heat or cold.

- cover is extremely difficult to classify and almost impossible to quantify.
- cover is usually related to a specific vegetation type

Density dependence - when a rate phenomenon (e.g. birth, death, emigration) fluctuates in response to changes in population density, it is said to exhibit density dependence.

Digestibility - the percentage of a particular food type or nutrient class (e.g. protein) actually absorbed by the animal (total minus losses in feces and urine).

Dispersal - an overall descriptive term for the movements of animals from the study area.

Estrus - that period of the reproductive cycle of female animals (the higher primates excepted) during which the female will accept the male - commonly known as heat.

Fitness - a relative measure of the ability of an organism to produce offspring which will survive to reproduce .

Home range - the area normally occupied by an animal during activities such as feeding, resting, and reproduction.

Intraspecific - between members of the same species.

Phenology - the study of the periodic (seasonal) phenomena of animal and plant life and their relations to the weather and climate.

Population - roughly defined as a group of individuals of a single species occupying a particular space at a particular time.

i. population density - a ratio of the number of individuals per square area.
ii. population discreteness - a descriptive term referring to the relative isolation of a population from adjacent populations.
iii. population fitness - like individual fitness, this term refers to the ability of a population to produce offspring which will survive to reproduce.
iv. resident population - refers to those members of a population which restrict their movements to a specific land area - e.g. a watershed.

v. viable population - refers to a population which is self-sustaining through time (if not increasing).

Resident - a grizzly that stays in one watershed throughout an annual cycle.

Subadults - that portion of the population which has not yet reached breeding age.

Transient - a grizzly that uses a watershed periodically, i.e. does not remain in a watershed for a complete annual cycle.

# APPENDIX A

## Bear Capture Data Sheet

## BEAR CAPTURE DATA SHEET

Bear #_____ Name_____
Date _____ _____ _____
Day Month Year
Personnel_____

Location Description: See Bear Location Sheet
Aerial_____
Snare_____ Bait_____ Trail_____ Transmitter_____
Time First Sighted____:____ Time First Chased____:____
Estimated weight_____lbs. _____ kg.
Chosen Dosage_____cc Drug_____
Chosen Needle Length 1" 1 1/8" 1 1/2" 2"

Dart 1 Dosage_____cc Hit Miss Injection Site_____
2 Dosage_____cc Hit Miss Injection Site_____
3 Dosage_____cc Hit Miss Injection Site_____
4 Dosage_____cc Hit Miss Injection Site_____
5 Dosage_____cc Hit Miss Injection Site_____

Range_____m
Time of First Hit_____:_____
First Effects Noted_____:_____
Fully Unconscious_____:_____
Handling Procedure Begun_____:_____
Neck Circumference_____mm
Collar Length_____mm
Transmitter Frequency_____mghz Serial #_____
Pulse rate_____
Teeth Extracted_____
Tooth Wear: Min_____ Mod_____ Maximal_____
Lip Tattoo #_____
Hair Sample Collected Dorsal Between Ears?
Ear Tag #_____ Left Colour_____ Right Colour_____
Sex? _____ Baculum Length_____mm Vulva Condition_____
Evidence of nursing_____
Comments_____
_____
Scat Sample Contents_____

Zygomatic Width_____mm CBL_____mm
Nose to Tail Tip_____mm
Shoulder Height_____mm
Heart Girth_____mm
Maximum Girth: Breath In_____mm Breath Out_____mm

| | T-S | PW |
|---|---|---|
| _____Hind Foot | | mm |
| _____Front Foot | | mm |

Blood Sample
Time Taken_____:_____
_____cc Plain _____cc EDTA _____cc Heparin _____cc Other
Body Weight_____lbs.kg Weighing Method_____
Antidote _____cc Site of Injection_____ Time_____
Recovery: Time First Active _____:_____
Time Standing Up_____:_____ Time Fully Recovered_____:_____
Pictures Taken?_____
Comments_____
_____
_____
_____
_____

| TIME | DURATION (between breaths) | TEMP (°C) |
|---|---|---|
| | | |

# APPENDIX B

## Aerial Survey Data Sheet

## Aerial Survey Data Sheet

Survey #_____
Map Reference_____
Date_____ _____ _____
Day Month Year

Aircraft Type_____
Aircraft Registration_____
Pilot_____
Navigator_____
Observers_____
_____
Time Finished (shutdown)_____
Time Started (startup)_____
Total Airtime_____ hrs.

Telemetry Equipment:
Receiver/Scanner_____
Antennae Type/Configuration_____
Primary Scan Speed_____
Power Source: internal____ external____

Weather:
Winds (velocity, direction)_____
Ceiling_____ft. A.S.L.
Visibility_____km.
Ground Temperature Start_____$^{o}$C
Finish_____$^{o}$C
Cloud Cover_____/10ths at_____ft. A.S.L.
Description_____
_____

General Location Description_____
_____
_____

| Frequencies Scanned | | | | | | Bear Locations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bear # | Bear Name | Fre-quency | Bracket | Time Added | Time Deleted | Map Loc-ation# | Bear # | Bear Name | Time | Comments |
| | | | + - | | | | | | | |
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Comments_____
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| Map Location # | Species | Number | | | | Habitat Type | Comments |
|---|---|---|---|---|---|---|---|
| | | Male | Fem | Yng | Unk | | |
| | | | | | | | |
| | | | | | | | |
| | | | | |

# AERIAL RELOCATION DATA SHEET

Bear Number _____
Survey # _____
Map Reference _____ Map Location # _____
Date _____ _____ _____
Day Month Year

Location # (since capture) _____
Time Located _____
Time 1st Received _____
Time Tracked _____

Aircraft Type _____
Aircraft Registration _____
Pilot _____
Navigator _____
Observers _____
_____

Watershed _____
UTM Coordinates Quadrant _____
Easting
□□□□□ ± □□□□ m
Northing
□□□□□□ ± □□□□ m

Bear Name _____

Weather _____
_____

Telemetry Relocations:
Air Survey Altitude _____ ft. A.S.L.
Receiving Distance _____ miles/kilometers
Pulse Rate _____
Frequency Range Low _____ High _____

1) Known Bears Sighted:
Habitat Type _____
Aspect _____
Slope _____
Elevation _____ ft. A.S.L.
Activity When 1st Sighted _____
Comments _____
_____

2) Radio Collared Bears Not Sighted:
Spatial Precision Estimation - i) Size and Shape (uncertainty area)

Comments _____
_____

3) Unknown Bears Sighted:
Slope _____
Aspect _____
Elevation _____ ft. A.S.L.
Activity When 1st Sighted _____
Size/Weight Estimation _____
Comments _____
_____

Colour _____
COY ____ Young ____ YRLG ____
Adult ____
Comments _____
_____
_____
_____

4) Habitat:

| | Species | Cover Estimate (%) |
|---|---|---|
| Trees / Deciduous | | |
| Trees \ Coniferous | | |
| Shrubs | | |
| Forbs | | |
| Suspected Food Type | | |

| | Scale | Number |
|---|---|---|
| Air Photos | | |
| | | |
| | | |

Forest Cover Map Type _____
Ecosystem Assoc. Type _____
Varient Type _____

Confidence in information for habitat selection analysis: i) Was location artifact of aircraft avoidance? _____ ii) Was location accurate enough for assigning specific habitat type? _____ iii) Precision Estimation: Diameter (outer points of polygon) _____ mm
Comments _____
_____
_____

# APPENDIX C

## Bear Activity Site
## Ground Investigation

# BEAR ACTIVITY SITE GROUND INVESTIGATION

Date: _____ _____ _____
Day Month Year

Location: Mapsheet _____
UTM Quadrant _____

Watershed _____

Easting ☐☐☐☐☐☐ m

Northing ☐☐☐☐☐☐☐ m

Photo # _____

Polar _____
r _____
θ _____

Personnel _____
_____

Method of Locating Activity Site:
Aerial Relocation _____
Ground Relocation _____
Other (specify) _____
_____
_____

Method of Access to Activity Site:
Aircraft _____
Boat _____
Vehicle _____
Foot _____

Known Bears:
Bear Number _____ Bear Name _____
Most Recent Location: # _____ Survey # _____ Date _____
Distance from Most Recent Location _____ Plot # _____

Unknown Bears:
Species _____
Individual suspected _____

Comments _____
_____

Site Description:
Aspect _____
Slope _____
Elevation _____ ft. m. A.S.L.
Vegetation Type _____
_____

Note: Detail of Site Classification depends on importance of site influences on bear location and known bear recent use.

Classification System _____
Site Description Form _____
Tree Form _____

Vegetation Data Sheet _____
Soil _____
Comments _____
_____

Nature of Activity Sign:
Tracks _____
(see Track Data sheet)
Scats _____ Scat # _____ Contents _____
Defecation Date _____ Individual Verification _____
Food Plant Remains _____ Species _____ Phenology _____ Sample _____
Fish/Animal Remains _____ Species _____ Sample _____
Marking Tree _____ Ground Marking _____ Description _____
Daybed _____ Substrate _____ Description _____

Wildlife Working Reports should not be cited because of the preliminary nature of the data they contain

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